3 (Sem–4/CBCS) CSC HC 1

2023

COMPUTER SCIENCE

(Honours Core)

Paper : CSC–HC–4016

(Design and Analysis of Algorithms)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. *(a)* Define dynamic programming. 1

(b) Insertion sort is faster than merge sort. 1

(State True ***or*** *False)*

(c) Routing in network relies on algorithm. 1

(State True ***or*** *False)*

(d) Quick sort is a 1

(i) greedy algorithm

(ii) divide and conquer algorithm

(iii) dynamic programming algorithm

(iv) backtracking algorithm

(Choose the correct option)

(e) What is the advantage of recursive approach than an iterative approach ? 1

(i) Consumes less memory

(ii) Consumes more memory

(iii) Less code and easy to implement

(iv) More code has to be written

(Choose the correct option)

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(f) What is the time complexity of depth first search algorithms ? 1

(i) $O(VE)$

(ii) $O(E \log V)$

(iii) $O(V \log E)$

(iv) $O(V + E)$

(Choose the correct option)

(g) When we say that an algorithm X is asymptotically more efficient than Y it means ? 1

(i) X will always be better for small inputs

(ii) X will always be better for large inputs

(iii) Y will always be better for small inputs

(iv) X will always be better for all inputs

(Choose the correct option)

2. (a) What do you mean by amortized analysis ? 2

(b) Analyse the time complexity of the following segment 2

```
for (i=0; i<N; i++) {
    for (j=N/2; j>0; j--) {
        sum ++ ;
    }
{
```

(c) What is minimum spanning tree ? Name the algorithms used for constructing minimum spanning tree. 1+1=2

(d) State the rules followed by a red black tree. 2

3. Answer ***any three*** of the following : 5×3=15

(a) Distinguish between dynamic programming and greedy method.

(b) Explain how recursive algorithms are analysed with an example.

(c) What are the advantages and disadvantages of divide and conquer approach ?

(d) Define theta (θ) notation. Prove that the function $f(x)=5x^4+7x+3$ is $\theta(x^4)$. 2+3=5

(e) Prove that running time of binary search algorithm in worst case is $O(log_2 N)$.

4. (a) Write the algorithm for merge sort and analyse its complexity for all cases. 4+2+2+2=10

Or

Use quick sort technique to sort the numbers 7 11 14 6 9 4 3 12 in ascending order. Illustrate the output of each pass clearly. 10

(b) Given a test $T[0....N-1]$ and a pattern $P[0....M-1]$ where $N > M$, write an algorithm to print all occurrence of $P[\ ]$ in $T[\ ]$. 10

Or

Write algorithms for insertion and deletion in a red black tree. 5+5=10

(c) Write algorithm for breadth-first search and mention its time and space complexity. Discuss the difference between breadth-first search and depth-first search algorithms. 5+5=10

Or

Discuss the differences between Kruskal's and Prim's algorithms. Apply Prim's algorithm to find the minimum spanning tree for the following graph : 5+5=10